REMARKS

Rejections Under 35 USC §102 and 35 USC §103

Claims 29-33, 35, 36, 40, 41, 49-51 and 53 have been rejected under 35 USC §102(b) as being anticipated by Watanabe et al. (US Patent No. 6,218,281 B1).

Claims 29-33, 35, 36, 40, 41, 49-51 and 53 have been rejected under 35 USC §102(e) as being anticipated by Hwang et al. (US Patent No. 6,455,408 B1).

Claims 42, 43, 45 and 46 have been rejected under 35 USC §103(a) as being unpatentable over Hwang et al. (US Patent No. 6,455,408 B1) in view of Kung et al. (US Patent No. 6,197,613 B1).

Claims 42, 43, 45 and 46 have been rejected under 35 USC §103(a) as being unpatentable over Watanabe et al. (US Patent No. 6,218,281 B1) in view of Kung et al. (US Patent No. 6,197,613 B1).

Claims 34, 54 and 55 have been rejected under 35 USC §103(a) as being unpatentable over Watanabe et al. (US Patent No. 6,218,281 B1) in view of Sambucetti et al. (US Patent No. 6,335,104 B1).

Claim 44 has been rejected under 35 USC §103(a) as being unpatentable over Watanabe et al. (US Patent No. 6,218,281 B1) in view of Kung et al. (US Patent No. 6,197,613 B1) as applied to claim 42 and further in view of Sambucetti et al. (US Patent No. 6,335,104 B1).

Claim 37 has been rejected under 35 USC §103(a) as being unpatentable over Hwang et al. (US Patent No. 6,455,408 B1) in view of Eichelberger et al. (US Patent No. 6,396,148 B1).

Claims 38, 39 and 52 have been rejected under 35 USC §103(a) as being unpatentable over Hwang et al. (US Patent No. 6,455,408 B1) in view of Goodman et al. (US Patent No. 5,910,644).

Claims 47 and 48 have been rejected under 35 USC §103(a) as being unpatentable over Hwang et al. (US Patent

No. 6,455,408 B1) in view of Kung et al. (US Patent No. 6,197,613 B1) as applied to claim 42 and further in view of Goodman et al. (US Patent No. 5,910,644).

The rejections under 35 USC §102 and 35 USC §103 are traversed for the reasons to follow.

Summary of the Invention

The claims are directed to a method for fabricating a semiconductor component. As shown in Figure 1A, the method includes the step of providing a substrate 14 comprising a semiconductor die 12 comprising a plurality of die contacts 20, and integrated circuits 26 (Figure 2G) in electrical communication with the die contacts 20. As also shown in Figure 1A, the method can include the step of forming a plurality of metal bumps 22 on the die contacts 20.

As shown in Figure 1B, the method includes the step of forming a polymer layer 30 on the die 12. In addition, the method can include the step of planarizing the polymer layer 30 and the metal bumps 22 to a same surface.

As shown in Figure 1C, the method includes the step of forming conductors 32 on the polymer layer 30 in electrical communication with the metal bumps 22. In addition, the conductors 32 include wire bonding pads 34 having a different pattern than that of the die contacts 20.

As shown in Figure 1D, the method includes the step of forming barrier/adhesion layers 36 on the conductors 22 and the wire bonding pads 34. As shown in Figure 1H, the barrier/adhesion layers 36 cover the edges of the conductors 22 and the wire bonding pads 34.

As shown in Figure 1E, the method includes the step of forming non-oxidizing layers 38 on the barrier/adhesion layers 36. As shown in Figure 1H, the non oxidizing layers 38 cover the edges of the barrier/adhesion layer 36, and provide wire bondable surfaces on the wire bonding pads 34.

As shown in Figure 1F, the method includes the step of forming second polymer layers 40 (Figure 1I) on the die 12

and the conductors 32 having openings 42 (Figure 1I) aligned with the bonding pads 34.

As shown in Figure 1G, the method includes the step of singulating the die 12 from the substrate 14.

As shown in Figure 4B, the method includes the step of wire bonding wires 64 to the wire bonding pads 34.

As shown in Figure 5C, the method can include the step of forming stud bumps (terminal contacts 70A) on the wire bonding pads 34.

35 USC §102 Rejections Of Claims 29-33, 35, 36, 40,41, 49-51 and 53 Over Watanabe et al.

Independent claims 29, 36 and 49 have been amended to include additional recitations which make the claims novel and unobvious over Watanabe et al. Amended independent claim 29 recites the step of "forming a non-oxidizing metal layer on the first metal layer covering the first metal layer and edges thereof configured to seal and protect the conductor and the wire bonding pad and to provide a wire bondable surface". Independent claims 36 and 49 include similar recitations. Antecedent basis for these recitations is contained on page 13, lines 2-10 of the specification.

The amended independent claims also recite the step of "forming a wire bonding pad". Antecedent basis for the "wire bonding pad" recitation is contained on page 10, lines 11-15 of the specification in reference to wire bonding pads 34.

Watanabe et al. discloses a semiconductor device which comprises a silicon substrate 40 having pads 42 and a conductive film 44 in electrical communication with the pads 42. In addition, in Figure 10 of Watanabe et al. a lower interconnect 47a made of Cu, and an upper

interconnect 47b made of Pd, Ni or Au (column 14, lines 1-6) are formed on the conductive film 44. However, the lower interconnect 47a and the upper interconnect 47b do not cover the edges of film 44 (See Figure 10 of Watanabe et al.). In addition, these films are configured for mounting a bump electrode 66, rather than to provide a "wire bonding pad" and a "wire bondable surface" as presently claimed.

35 USC §102 Rejections Of Claims 29-33, 35, 36, 40,41, 49-51 and 53 Over Hwang et al.

The above identified recitations in independent claims 29, 36 and 49 are also submitted to make the claims novel and unobvious over Hwang et al. In Hwang et al. the UBM layers 78 can comprise a non-oxidizing metal, but the redistribution pattern 64 (i.e., redistribution conductors) are not sealed and protected by non-oxidizing layers on the surface and edges thereof. The cited reference thus does not disclose all of the features of the amended claims. Further, there would be no reason to seal the redistribution pattern 70 (i.e., redistribution conductors) and UBM layers 78 in Hwang et al. because the polymer layer 74 and the solder bumps 80 cover these elements. In the present case the non-oxidizing layers seal and protect both the redistribution conductors and the wire bonding pads.

35 USC §103 Rejections Of Claims 42, 43, 45 and 46 Over Hwang et al. in view of Kung et al.

Amended independent claim 42 recites the step of "forming non-oxidizing layers on the barrier/adhesion layers and edges thereof configured to seal the conductors and the wire bonding pads and to provide wire bondable surfaces". As previously argued Hwang et al. does not disclose or suggest this feature of the present method.

In addition, independent claim 42 recites the step of "forming a plurality of metal bumps on the die contacts", "forming a polymer layer on the die" and "planarizing the polymer layer and the metal bumps to a same surface".

Kung et al. was cited as teaching forming a redistribution structure in which a metal bump 68 (Figure 2F) is formed on a die contact 54, and then planarized to a same surface as a polymer layer 70 (Figure 2G). However, in Figure 2G of Kung et al. the polymer layer 70 covers the bump 68. In Figure 2H of Kung et al. the polymer layer 70 is etched to expose portions of the bump 68 (column 8, lines 32-35). Kung et al. thus does not teach the step of planarizing a polymer layer and metal bumps on die contacts to a same planar surface. One advantage of the present step is that a planar surface is provided for forming the conductors 34, and electrically connecting the conductors 34 to the die contacts 20.

35 USC §103 Rejections Of Claims 42, 43, 45 and 46 Over Watanabe et al. in view of Kung et al.

Amended independent claim 42 recites "forming non-oxidizing layers on the barrier/adhesion layers and edges thereof configured to seal the conductors and the wire bonding pads and to provide wire bondable surfaces". As previously argued Watanabe et al. does not disclose or suggest this feature of the present method.

As also previously argued, Kung et al. does not disclose the steps of "forming a plurality of metal bumps on the die contacts", "forming a polymer layer on the die" and "planarizing the polymer layer and the metal bumps to a same surface".

35 USC §103 Rejections Of Claims 34, 54 and 55 Over Watanabe et al. in view of Sambucetti et al.

Dependent claims 34 recites the step of "wire bonding a wire to the wire bonding pad". Dependent claims 54 and

55 include similar wire bonding recitations to stud bumps on the wire bonding pads.

Sambucetti et al. was cited as disclosing "that the same bonding pad with a structure similar to that of Watanabe (See Sambucetti, column 5, line 60-column 6, line 15) can be used for both flip chip bonding using a solder ball/bump or for wire bonding (figures 1 and 2: column 2, lines 20-30)."

However, amended independent claims 29 and 53 recite the step forming non oxidizing layers on the edges of the conductors and the bonding pads. As previously argued, this feature is not disclosed or suggested by the combination of Watanabe et and Sambucetti et al.

35 USC §103 Rejection Of Claim 44 Over Watanabe et al. in view of Kung et al. and Sambucetti et al.

Dependent claim 44 recites the step of "forming a plurality of wire bonds on the wire bonding pads". Sambucetti et al. was cited as anticipating this step. However, amended independent claim 42 includes recitations as argued above, which distinguish from the combination of Watanabe et al. and Kung et al.

35 USC §103 Rejection Of Claim 37 Over Hwang et al. in view of Eichelberger et al.

Dependent claim 37 recites "the forming the conductors step and the forming the wire bonding pads step comprise electrolessly depositing a first metal". Eichelberger was cited as anticipating this step.

However, as previously argued, amended independent claim 36 includes recitations which distinguish the claimed method from the combination of Hwang et al. and Eichelberger et al.

35 USC §103 Rejections Of Claims 38, 39 and 52 Over Hwang et al. in view of Goodman et al.

Dependent claims 38 and 39 recite electroless deposition steps. Goodman et al. was cited as anticipating electroless deposition. However, as previously argued, independent claim 36 includes recitations which distinguish from the combination of Hwang et al. and Goodman et al.

Dependent claim 52 states that "the non-oxidizing layer completely seals the conductors and the wire bonding pads". Goodman et al. was cited as teaching "that it is advantageous to coat a copper terminal layer (33) with nickel and gold (a non oxidizing layer), such that the nickel completely covers the copper and the gold completely covers the nickel (see Figure 5)."

Admittedly, in Goodman et al. the pads 33 can be used for wire bonding. However, Goodman et al. is directed to a flexcable 10 wherein "a base 32 of flexible, electrically insulating material supports conductors which terminate at pads 33" (column 5, lines 31-33). In contrast, amended independent claim 49 recites the step of "providing a semiconductor die including a circuit side, a plurality of integrated circuits, and a plurality of die contacts on the circuit in electrical communication with the integrated circuits". The present method thus provides an active semiconductor die rather than a flexcable.

Although Goodman et al. and Hwang et al. in combination disclose a wire bonding pad (pads 33 in Goodman et al.) and integrated circuits (substrate 52 in Hwang et al.), there would be no incentive to make the proposed combination, because the stated purpose of the semiconductor device in Hwang et al. is to prevent shearing stresses on solder bumps attached to a printed circuit board (column 2, lines 1-12). A wire bonding pad in Hwang et al. would defeat the purpose of the solder bumps 80 and the pads 33. References are not properly combinable or

modifiable if their intended function is destroyed, In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

35 USC §103 Rejections Of Claims 47 and 48 Over Hwang et al. in view of Kung et al. and Goodman et al.

Dependent claim 47 recites "the forming the barrier/adhesion layer step comprises electrolessly depositing Ni." Dependent claim 48 recites "the forming the non-oxidizing layer step comprises electrolessly depositing Au." Goodman et al. was cited as teaching electrolessly deposited metal layers which completely cover edges of the conductive layer. However, as previously argued, Goodman et al. electrolessly deposits on a flexcable rather than on an active semiconductor device. In addition, one skilled in the art would have no incentive to make the proposed combination of Hwang et al. and Goodman et al. because the stated purpose of Hwang et al. would be defeated.

Conclusion

In view of the amendments and arguments favorable consideration and allowance of claims 29-55 is respectfully requested. Please note that Applicant has filed an IDS dated June 25, 2004. In addition, the title has been amended to be more descriptive of the claimed subject matter.

Should any other issues be present which would prevent allowance of this application, the Examiner is asked to contact the undersigned by telephone.

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